**Al- Mustaqbal University**

**College of Sciences**

**Department of Cybersecurity**

**Principles of Cyber Security**

**First stage**

**Lecture 5**

**Managing Network Security**

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**Overview**

This lecture focuses on security threats directed at endpoints, such

as servers, workstations, and mobile devices, that are attached to

an enterprise network or the Internet. Detailed discussion of the

countermeasures implemented on the endpoints, such as antivirus

software, is beyond our scope. Instead, this lecture looks at

endpoint security from a network perspective.

**Lecture Objectives**

**5.1** List and discuss the various types of firewalls and the common

approaches to firewall implementation.

**5.2** Define and describe the types of intrusion detection and

prevention systems and the strategies on which they are based

**OB.5.1:** List and discuss the various types of firewalls and the common

approaches to firewall implementation.

**5.1.1 Managing Network Security**

The InfoSec professionals are under increasing pressure to provide

global access to information assets without sacrificing security.

**Firewalls:**

The firewall is an important complement to host-based security

services such as intrusion detection systems. Typically, a firewall is

inserted between the premises network and the Internet to

establish a controlled link and to erect an outer security wall or

perimeter. The aim of this perimeter is to protect the premises

network from Internet-based attacks and to provide a single choke

point where security and auditing can be imposed. Firewalls are

also deployed internal to the enterprise network to segregate

portions of the network.

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The firewall provides an additional layer of defense, insulating

internal systems from external networks or other parts of the

internal network. This follows the classic military doctrine of

“defense in depth,” which is just as applicable to IT security.

**Firewall Characteristics**

1. All traffic from inside to outside, and vice versa, must pass through

the firewall. This is achieved by physically blocking all access to the

local network except via the firewall. Various configurations are

possible, as explained later in this section.

2. Only authorized traffic, as defined by the local security policy, will

be allowed to pass. Various types of firewalls are used, which

implement various types of security policies, as explained later in

this lecture.

3. The firewall itself is immune to penetration. This implies the use

of a hardened system with a secured operating system (OS).

Trusted computer systems are suitable for hosting a firewall and

are often required in government applications.

**Types of Firewalls**

A firewall may act as a packet filter. It can operate as a positive filter,

allowing to pass only packets that meet specific criteria, or as a

negative filter, rejecting any packet that meets certain criteria.

Depending on the type of firewall, it may examine one or more

protocol headers in each packet, the payload of each packet, or the

pattern generated by a sequence of packets. In this section, we look

at the principal types of firewalls.

Firewalls are security devices or software that monitor and control

incoming and outgoing network traffic based on predetermined

security rules. There are several types of firewalls, each with its own

characteristics and functionalities. Here are some common types

of firewalls:

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▪ **Packet Filtering Firewalls:**

• Examines individual packets of data and makes decisions

to allow or block them based on predefined rules.

▪ **Stateful Inspection Firewalls:**

• Keeps track of the state of active connections and makes

decisions based on the context of the traffic.

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▪ **Proxy Firewalls:**

• Acts as an intermediary between internal and external

networks, handling communication on behalf of the

clients.

▪ **Application-layer Gateways (Proxy Firewalls):**

• Monitors and filters traffic at the application layer,

providing more detailed control over specific applications

or services.

▪ **Circuit-level Gateways:**

• Works at the session layer of the OSI model, making

decisions based on the context of the traffic's source and

destination.

▪ **Next-Generation Firewalls (NGFW):**

• Integrates traditional firewall features with additional

capabilities such as intrusion prevention, deep packet

inspection, and application awareness.

▪ **Hardware Firewalls:**

• Implemented as a standalone physical device, often used

to protect an entire network.

▪ **Software Firewalls:**

• Implemented as a software application, often installed on

individual devices.

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**OB.5.2:** Define and describe the types of intrusion detection and

prevention systems and the strategies on which they are based.

**5.2.1 Intrusion Detection and Prevention Systems**

**Intrusion:**

Violations of security policy, usually characterized as

attempts to affect the confidentiality, integrity, or availability of a

computer or network. These violations can come from attackers

accessing systems from the Internet or from authorized users of

the systems who attempt to overstep their legitimate

authorization levels or who use their legitimate access to the

system to conduct unauthorized activity.

**Intrusion detection:**

The process of collecting information about

events occurring in a computer system or network and analyzing

them for signs of intrusions.

**Intrusion detection system:**

Hardware or software products that

gather and analyze information from various areas within a

computer or a network for the purpose of finding, and providing

real-time or near-real-time warning of, attempts to access system

resources in an unauthorized manner.

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**Intrusion detection systems (IDSs) can be classified as**

**follows:**

■ **Host-based IDS:**

Monitors the characteristics of a single host

and the events occurring within that host for suspicious activity.

This vantage point allows host-based IDSs to determine exactly

which processes and user accounts are involved in a particular

attack on the OS. Furthermore, unlike network-based IDSs, hostbased

IDSs can more readily see the intended outcome of an

at tempted attack, because they can directly access and monitor

the data files and system processes usually targeted by attacks.

■ **Network-based IDS:**

Monitors network traffic for particular

network segments or devices and analyzes network, transport,

and application protocols to identify suspicious activity.

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